Federal Aviation Administration

EFB ELECTROMAGNETIC COMPATIBILITY (EMC) ASSESSMENT

Portable Electronic Device (PED) as Electronic Flight Bag (EFB)

The use of this checklist is not mandatory, but may be used in accordance with AC 120-76B "Method 2"

OPERATOR	
Company	
Name	
Address 1	
Address 2	
City, ST, Zip	
Phone	
eMail	
EFB *	
EFB Make	
EFB Model	
Serial#	
FCC ID (if applicable)	
AIRCRAFT **	
Aircraft Make	
Aircraft Model	
Aircraft N#	

*Testing for a particular EFB make/model may be credited to other EFBs of the same make/model or emissions footprint.
**Testing for a particular aircraft make/model may be credited to other similarly equipped aircraft of the same make/model.

RESULTS	
PASS or FAIL	
Signed (by hand or electronic)	
Title	
Date	
Testing Facility (if applicable)	

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INTRODUCTION

This document provides step-by-step test procedures to demonstrate electromagnetic compatibility for a portable (secured and viewable) or mounted Electronic Flight Bag. These checks ensure that the PED/EFB will not have any adverse effects on previously installed aircraft systems, or that the airplane equipment will induce a change in the PED/EFB display or other functions.

NOTE: This checklist is not intended to replace or supersede the aircraft certification requirements for High Intensity Radiated Fields (HIRF) or PED tolerance (RTCA DO-307). The objective of this checklist is to aid the operator in an assessment of risk in the operation of an FCC compliant portable electronic device used as an EFB or portable GNSS source. Unique from other PEDs, these devices are controlled by the operator, with known emissions, tested in specific locations, and subject to ground and flight checks. Additionally, EFB program implementation requires direct surveillance by the flight crew and line validation to ensure that the PED meets its intended function.

This test procedure must be performed and submitted for each model of EFB used and each model of aircraft you operate. Testing for a particular EFB make/model may be credited to other EFB make/model of similar emissions footprint. Testing for a particular aircraft make/model may be credited to other similarly equipped aircraft of the same make/model. Information pertaining to the emissions characteristics of PEDs is typically obtained from test reports resulting from qualification to standards such as RTCA/DO-160 section 21 (or equivalent) or applicable Federal Communications Commission (FCC) requirements. FCC test report data may be found at: http://transition.fcc.gov/oet/ea/fccid/. Examining the test data allows the operator relief from checking the listed frequencies for the avionics component; leaving only frequencies for which the test data depicts unusual peaks or is of particular interest. Applicable sections of the FCC test report include, but may not be limited to, those sections related to spurious and/or radiated emissions, addressing the requirements of CFR 47 15.205 and/or 15.209, 15.247(d).

NOTE 1: The test procedures in this checklist are not necessary if the aircraft and applicable avionics equipment has been demonstrated to be compliant RTCA/DO-307, Aircraft Design and Certification for Portable Electronic Device (PED) Tolerance, for both back door and front door coupling."

"NOTE 2: Due to differences in production and certification standards, some PED devices intended for general consumer use meet applicable FCC regulations, but may not be fully compliant to RTCA/DO-160 section 21 aircraft equipment standards. In that case, the operator may use this document as an acceptable means of determining electromagnetic compatibility. Alternately, the operator may analyze a formal report on the device model, completed according to RTCA DO-160 section 21, and use the method of testing outlined here, against the specific frequencies from the test report that exceed the envelope of the DO-160 standard.

APPLICABILITY

Electromagnetic compatibility (EMC) testing, also known as EMI/Electromagnetic non-interference testing, is required for certain operators (e.g., 14 CFR Part 91K, Part 135 and Part 121) that intend to use an Electronic Flight Bag during critical phases of flight. Refer to the policy documents, below. FAA policy [AC 120-76B, 11.f.(2)] outlines two acceptable methods for achieving the objective. This document is used in conjunction with "Method 2".

Test results are submitted to your Principle Operations Inspector (POI) as part of your EFB application package, in pursuit of OpSpec or MSpec A061 authorization for use of Electronic Flight Bags. For users operating under 14 CFR Part 91 Subpart F, test records are retained as part of "self compliance."

REFERENCE DOCUMENTS

Compliance with these procedures is in accordance with the following FAA documents.

- FAA AC 120-76B, *"Guidelines for the Certification, Airworthiness, & Operational Use of Portable Electronic Flight Bags"*
- FAA AC 91.21-1B, *"Use of Portable Electronic Devices Aboard Aircraft"*
- FAA Order 8900.1 Volume 4, Chapter 15, Section 1, *"Electronic Flight Bag Operational Authorization Process"*
- FAA Information for Operators (InFO 11011), *"The Apple iPad and Other Suitable Tablet Computing Devices as Electronic Flight Bags (EFB)"*

These policies are subject to change in the future, which could impact the validity of this test procedure. You are required to follow current EFB policies, so we recommend that you monitor and review policies as they are revised.

GENERAL

TEST REQUIREMENTS

Prior to performing Ground and Flight checks, verify that the EFB(s) and all aircraft systems are working properly.

TEST ENVIRONMENT

The test environment should be free from electromagnetic influence that has the potential to affect test results. All ground checks should be conducted away from other operating aircraft, with sufficient power applied to enable all aircraft systems, with engines running and all lighting on.

INSTRUCTIONS FOR COMPLETING THE REPORT

- Complete the cover page with all requested details about the aircraft operator, the representative EFB(s), the aircraft fleet, the specific aircraft used, and the person(s) performing the test.
- In the spaces designated "RESULTS", place a checkmark or an "X" in the field under "SAT" if the step produced satisfactory results, under "UNSAT" if the results were unsatisfactory, or under "N/A" if the test section is Not Applicable. For any N/A response, add a short comment as to why it is not applicable.
- In the space called "COMMENTS," add any additional written comments if appropriate to explain a situation or to add clarity.

(continued)

PHASE 1 – GROUND TEST PROCEDURE

The objective of the test is to verify that the Portable Electronic Devices (PEDs) are electromagnetically compatible with the communication and navigation systems on the aircraft. Operation of PEDs should not result in NAV flags, noise on COMM channels, and interference over headsets, or other adverse effects. The ground test is required prior to the Phase 2 flight test. A qualified pilot or maintenance technician should operate the aircraft systems as listed below and check the operation of any PEDs to be used.

TEST SETUP

Prior to starting the test, prepare the system as follows.

- Make sure airplane involved in the test is away from other operating aircraft.
- Ensure that all aircraft systems are safe and secure.
- Engine(s) should be running, and all lighting should be turned on.
- Apply power on to all aircraft systems.
- Locate and configure the EFB as it will be used during flight. If multiple EFBs are used in your intended configuration, then place all EFBs in their normal location in the cockpit. Include power adapters, chargers, cables, external GPS units, accessories, etc.

PED LOCATION	

- Verify the aircraft power interface is connected with the EFB(s), if applicable.
- Turn the EFB(s) on.
- Many current devices have multiple emissions modes, for example Bluetooth, WiFi, and Cellular. For Ground Checks, it is recommended to test with all available modes turned on, even if they are not intended to be on during actual EFB use. This tests for “worst case” scenarios.
- Open a software application(s) that is intended for use in critical phases of flight and enter a mode, if applicable, that invokes radio emissions, e.g., a moving map that is communicating with a Bluetooth GPS, or connectivity to WiFi.

	N/A	SAT	UNSAT
RESULTS: **Test Setup**			
COMMENTS:			

(continued)

GROUND TESTING AND RESULTS

After proper setup is completed and verified, complete the testing and indicate the outcome for each of the systems below.

A. VHF COMM RECEIVER

Complete the chart below. First, check field or local frequencies (ATIS, local ground, tower, etc) to listen to the quality of the received signals from those systems. Record local or field frequencies used in the spaces provided in the table below Listen for audio noise. If noise is present shut down the PED(s) to determine if it is inducing the noise. Next, tabulate the below VHF Comm channels between 118 and 135 MHz: With the PED(s) displaying EFB information, open Comm squelch, and check each of the tabulated VHF 1 Comm frequencies.

- Record frequencies where PED-induced audio noise is present (if any).
- Repeat steps for additional VHF Comm Receivers, if any.
- Record results.

RESULTS: **A. VHF COMM RECEIVER**									
Field/local frequencies									
Frequency	SAT	UNSAT		Frequency	SAT	UNSAT	Frequency	SAT	UNSAT
Tabulated frequencies									
Frequency	SAT	UNSAT		Frequency	SAT	UNSAT	Frequency	SAT	UNSAT
118 MHz				124 MHz			130 MHz		
119 MHz				125 MHz			131 MHz		
120 MHz				126 MHz			132 MHz		
121 MHz				127 MHz			133 MHz		
122 MHz				128 MHz			134 MHz		
123 MHz				129 MHz			135 MHz		
COMMENTS:									

Note: If equipped, tabulate frequencies 136 MHz - 156 MHz at 1 MHz intervals. Write results in the 'comments'.

Alternate method. Targeted Frequencies. The operator may opt to check only those frequencies of interest indicated by the PED qualification test report. Inspect the report to determine frequencies within the VHF Comm band (118 to 156 MHz) with highest RF emissions. The PED qualification test report should include data from RTCA/DO-160 section 21, an equivalent standard, or the PED FCC qualification report. Tabulate these frequencies and the adjacent channels above and below these frequencies:

RESULTS: **A. VHF COMM RECEIVER (Alternate Method – Targeted Frequencies)**									
Frequency	SAT	UNSAT		Frequency	SAT	UNSAT	Frequency	SAT	UNSAT
COMMENTS:									

(continued)

B. VHF COMM TRANSMITTER

This check verifies that the VHF COMM transmitter does not interfere with the display of the EFB.
With the PED(s) displaying EFB information, transmit at each of the following VHF 1 Comm frequencies:

- Key radio at each frequency and observe PED(s) for any change in display or other indication of interference between systems.
- Repeat steps for additional VHF Comm Transmitters, if any.
- Record results.

RESULTS: **B. VHF COMM TRANSMITTER**										
Frequency	SAT	UNSAT		Frequency	SAT	UNSAT		Frequency	SAT	UNSAT
118 MHz				124 MHz				130 MHz		
121 MHz				127 MHz				133 MHz		
COMMENTS:										

Note: If equipped, tabulate frequencies 136 MHz - 156 MHz at 3 MHz intervals. Write results in the space above.

C. VHF NAV AND DME TRANSMITTER/RECEIVER

PART 1: VOR/VOT Check.

- With the PED(s) turned OFF, tune to a local VOR/VOT station.
- Verify that the VOR/VOT ground check is successful.
- With the PED(s) operating, observe VOR/VOT operation
- Verify that the VOR/VOT ground check is successful and ensure the indication remains steady and constant.
- Repeat steps for additional VOR/VOT stations within receiving distance (if any) and repeat checks.
- Repeat steps for additional VHF NAV Receivers, if any.
- Record results.

RESULTS: **C. VHF NAV & DME TRANSMITTER/RECEIVER, PART 1 (VOR/VOT)**										
Frequency	SAT	UNSAT		Frequency	SAT	UNSAT		Frequency	SAT	UNSAT
COMMENTS:										

If successful, complete LOC/GS/DME Part 2.

(continued)

PART 2: LOC/GS/DME Frequency Checks.

Field/Local Frequencies:

- With the PED(s) turned off, tune the LOC/GS/DME to capture a local station.
- Observe the indications and ensure the captured signals remain steady and constant.
- With the PED(s) operating, select Nav 1 and DME 1 audio and listen for interference and for audio noise.
- Observe distance displays (DME) and CDI/LOC/GS needles for erroneous readings.
- If any audio or display variations are observed, shut down the PED(s) and observe if audio or display variation is still present.
- Tune to any additional stations that are within reception range (if any) and repeat test for additional Navs.
- Record observed frequencies in table below.

Then, tabulate the below VHF Nav channels between 108 and 118 MHz:

- Tune the Nav radios to each of the tabulated VOR/LOC/GS/DME channels in table below. .
- Observe distance displays (DME) and CDI/LOC/GS needles for erroneous readings.
- Record frequencies and phenomenon observed, if any.
- Repeat steps for additional VHF Nav/DME Transmitters/Receivers, if any.
- Record results.

RESULTS: C. LOC/GS/DME Frequency Checks, PART 2 (FREQUENCY CHECKS)										
Field/local frequencies										
Frequency	SAT	UNSAT		Frequency	SAT	UNSAT		Frequency	SAT	UNSAT
Tabulated frequencies										
Frequency	SAT	UNSAT		Frequency	SAT	UNSAT		Frequency	SAT	UNSAT
108 MHz				112 MHz				116 MHz		
109 MHz				113 MHz				117 MHz		
110 MHz				114 MHz				118 MHz		
111 MHz				115 MHz						
COMMENTS:										

(see next page for alternate means to perform a check of the VHF NAV & DME transmitter/receiver functions.)

(continued)

C. PART 2, LOC/GS/VOR Alternate Method 1. In lieu of flight testing, the LOC/GS/VOR may be tested using appropriate ground test equipment. To qualify, the test equipment must be able to test each of the frequencies listed in the table below. In addition, the test equipment must have the ability to adjust/vary the transmit power to properly set up the test scenario.

- Set up the test equipment to transmit the selected test frequency.
- With the PED(s) turned off, tune the LOC/GS/DME to capture test frequency. Ensure that the signal is properly captured and indications are steady.
- Adjust the transmit power of the test equipment until the aircraft system starts to lose capture of the signal. Determine that value then add 3 DB of signal strength to the transmitted power to complete the test.
- Observe the indications and ensure the captured signals remain steady and constant.
- With the PED(s) operating, observe distance displays or Nav indications for the systems under test for erroneous readings.
- For LOC/GS, vary the test signal output to simulate 1 dot up/down or 1 dot left/right. For the VOR, vary the bearing up to 30 degrees. Observe indications for the systems under test for erroneous readings.
- If display variations are observed, shut down the PED(s) and observe if audio or display variation is still present.
- Record frequencies and phenomenon observed, if any.
- Repeat steps for additional VHF Nav/DME Transmitters/Receivers, if any.
- Record results.

RESULTS: **C. VHF NAV/DME TRANSMITTER/RECEIVER, PART 2 (FREQUENCY CHECKS, Alternate Method 1)**										
Frequency	SAT	UNSAT		Frequency	SAT	UNSAT		Frequency	SAT	UNSAT
108 MHz				112 MHz				116 MHz		
109 MHz				113 MHz				117 MHz		
110 MHz				114 MHz				118 MHz		
111 MHz				115 MHz						
COMMENTS:										

C. PART 2, LOC/GS/VOR Alternate Method 2. Targeted Frequencies.

The operator may opt to check only those frequencies of interest indicated by the PED qualification test report. Inspect the PED qualification test report to determine frequencies within the VOR/LOC band (112 to 118 MHz), the glide slope (328 to 336 MHz), and DME (960 to 1215 MHz) with highest RF emissions. The PED qualification test report should include data from RTCA/DO-160 section 21, or an equivalent standard. If RTCA/DO-160 section 21 qualification data is not available, inspect the PED FCC qualification report. Tabulate these frequencies and the adjacent channels above and below these frequencies. A chart of DME pairing frequencies has been provided in Appendix A, if required.

RESULTS: **C. LOC/GS/VOR, PART 2 (FREQUENCY CHECKS, (Alternate Method 2)**										
Frequency	SAT	UNSAT		Frequency	SAT	UNSAT		Frequency	SAT	UNSAT
COMMENTS:										

(continued)

D. MARKER BEACON

NOTE: This section is optional. Per the findings of RTCA DO-294 and DO-307, the Marker Beacon is not likely to be affected by PED emissions for front door effects.

- With PED(s) displaying EFB information, Select #1 marker audio "ON".
- If any audio noise is present, shut down the PED(s) to determine if it is generating the noise.
- Repeat steps for additional Marker Beacon radios, if any.
- Record results.

	N/A	SAT	UNSAT
RESULTS: **D. MARKER BEACON**			
COMMENTS:			

E. ADF RECEIVER

NOTE: This section is optional. Per the findings of RTCA DO-294 and DO-307, the ADF antenna and receiver is not likely to be affected by PED emissions for front door effects.

Complete the chart below. Tabulate the below ADF channels between 190 and 1799 KHz:

With the PED(s) displaying EFB information, check each of the tabulated ADF frequencies.

- With ADF audio selected listen for any audio noise.
- If any audio noise is present, shut down the PED(s) to determine if it is generating the noise.
- Repeat steps for additional ADF Receivers, if any.
- Record results.

RESULTS: **E. ADF RECEIVER**										
Frequency	SAT	UNSAT		Frequency	SAT	UNSAT		Frequency	SAT	UNSAT
190 KHz				800 KHz				1400 KHz		
400 KHz				1000 KHz				1600 KHz		
600 KHz				1200 KHz				1700 KHz		
COMMENTS:										

Alternate method. Targeted Frequencies. The operator may opt to check only those frequencies of interest indicated by the PED qualification test report. Inspect the PED qualification test report to determine frequencies within the ADF band (190 to 1799 kHz) with highest RF emissions. The PED qualification test report should include data from RTCA/DO-160 section 21 or an equivalent standard. If RTCA/DO-160 section 21 qualification data is not available, inspect the PED FCC qualification report. Tabulate these frequencies and the adjacent channels above and below these frequencies.

RESULTS: **E. ADF RECEIVER (Alternate Method)**										
Frequency	SAT	UNSAT		Frequency	SAT	UNSAT		Frequency	SAT	UNSAT
COMMENTS:										

(continued)

F. FLIGHT DIRECTOR/AUTOPILOT

- With PED(s) displaying EFB information, exercise Flight Director/Autopilot, with autopilot engaged thru its various modes.
- If any jitter, erroneous indication or flag problems are observed, shut down the PED(s) to determine if it is causing the problem.
- Repeat steps for additional Flight Director/Autopilot systems, if any.
- Record results.

	N/A	SAT	UNSAT
RESULTS: **F. FLIGHT DIRECTOR / AUTOPILOT**			
COMMENTS:			

G. CABIN PAGING SYSTEM

- With PED(s) displaying EFB information, select PAGE at the Pilots Audio Panel and key the microphone.
- Observe PED(s) for any change in display or other indication of interference between systems.
- Repeat for the Copilot.
- Record results.

	N/A	SAT	UNSAT
RESULTS: **G. CABIN PAGING SYSTEM**			
COMMENTS:			

H. COMPASS SYSTEMS

- Shut down PED(s).
- Position aircraft on known magnetic heading.
- Record compass heading from #1, #2, and Magnetic compasses:

#1		#2		MAG	

- Restart PED(s).
- Record compass heading from #1, #2, and Magnetic compasses again:

#1		#2		MAG	

- Compare compass readings to previous readings, noting any differences.
- Record results.

	N/A	SAT	UNSAT
RESULTS: **H. COMPASS SYSTEMS**			
COMMENTS:			

I. HF RECEIVER

NOTE: This section is optional. Per the findings of RTCA DO-294 and DO-307, the HF antenna and receiver is not likely to be affected by PED emissions for front door effects.

Complete the chart below. Tabulate the below HF band frequencies (2 to 30 MHz):

- With the PED(s) displaying EFB information, check each of the tabulated HF frequencies:
  If any audio noise is present, shut down the PED(s) to determine if it is generating the noise.
- Record frequencies where PED-induced audio noise is present (if any).
- Repeat steps for additional HF Receivers, if any.
- Record results.

RESULTS: **I. HF RECEIVER**										
Frequency	SAT	UNSAT		Frequency	SAT	UNSAT		Frequency	SAT	UNSAT
2 MHz				12 MHz				22 MHz		
4 MHz				14 MHz				24 MHz		
6 MHz				16 MHz				26 MHz		
8 MHz				18 MHz				28 MHz		
10 MHz				20 MHz				30 MHz		
COMMENTS:										

Alternate method. Targeted Frequencies. The operator may opt to check only those frequencies of interest indicated by the PED qualification test report. Inspect the PED qualification test report to determine frequencies within the HF band (2 to 30 MHz) with highest RF emissions. The PED qualification test report should include data from RTCA/DO-160 section 21 or an equivalent standard. If RTCA/DO-160 section 21 qualification data is not available, inspect the PED FCC qualification report. Tabulate these frequencies and the adjacent channels above and below these frequencies.

RESULTS: **I. HF RECEIVER (Alternate Method)**										
Frequency	SAT	UNSAT		Frequency	SAT	UNSAT		Frequency	SAT	UNSAT
COMMENTS:										

J. HF TRANSMITTER

This check verifies that the HF transmitter does not interfere with the display of the EFB.
With the PED(s) displaying EFB information, check each of the following HF frequencies (MHz):

- Key radio at each frequency and observe EFB for any change in display or other indication of interference.
- Record observations, if any.
- Repeat steps for additional HF Transmitters, if any.
- Record results.

RESULTS: **J. HF RECEIVER**										
Frequency	SAT	UNSAT		Frequency	SAT	UNSAT		Frequency	SAT	UNSAT
2.50 MHz				8.00 MHz				24.50 MHz		
4.25 MHz				17.00 MHz				28.50 MHz		
COMMENTS:										

(continued)

K. GPS/FMS POSITION

- Shut down PED(s).
- Ensure correct airplane position is displayed.
- Restart PED(s), and re-launch EFB application to a typical state.
- Check that the same/correct airplane position is displayed.
- If applicable, display the satellite status page and cycle power on the PED. Verify that GPS signal strength is not affected by the operation of the PED.
- Record results.

	N/A	SAT	UNSAT
RESULTS: **K. GPS/FMS POSITION**			
COMMENTS:			

L. OTHER AIRCRAFT SYSTEMS

This section is optional, reserved for other systems, as required. Other systems may include, but are not limited to: Fire Detection Systems, Cabin Emergency Lighting, additional considerations for electronic Flight Controls ('fly-by-wire), Flight Data Recorder, etc.

For each additional aircraft system:

- Verify that there is no adverse effect on flight instruments with the PED(s) operating.
- If interference or abnormal operation is detected, turn the PED(s) OFF.
  - If interference or abnormal operation goes away, there is likely interference from the PED(s).
  - If interference or abnormal operation persists with the PED(s) OFF, the cause may be interference from other devices or faulty aircraft systems.
- Record results.

RESULTS: **L. OTHER AIRCRAFT SYSTEMS**		
System/Component Name:	SAT	UNSAT
COMMENTS:		
System/Component Name:	SAT	UNSAT
COMMENTS:		

End of GROUND TESTING, PHASE 1.

If the results were successful, you may proceed to FLIGHT TESTING, PHASE 2.

PHASE 2 – FLIGHT TEST PROCEDURE

NOTE: Ensure that successful results are achieved from GROUND TESTING, PHASE 1 before proceeding.

The PED(s) should be placed in the location(s) where the devices will normally be operated. Operation of PEDs should not result in NAV flags, noise on COMM channels, and interference over headsets, or other phenomena. If the PED(s) are equipped with a wireless connection that is used in flight, it should be enabled. The following items must be checked for non-interference in day-VMC conditions.

NOTE: Unless otherwise authorized, cellular functions that are prohibited by the FCC should not be used.

RESULTS: **PHASE 2 – FLIGHT TEST PROCEDURE**			
	N/A	SAT	UNSAT
FMS: Normal FMS Operations			
Communications: VHF			
Communications: HF			
Communications: SATCOM			
Displays: Primary & Multi-Function			
Radar: Airborne Radar			
Enroute: GPS operations			
Enroute: VOR operations			
Enroute: NDB operations			
Enroute: RNAV			
Approach: ILS Standard, coupled (check Marker Beacon if available)			
Approach: ILS Standard, uncoupled (check Marker Beacon if available)			
Approach: ILS Back-course Localizer* (check Marker Beacon if available)			
Approach: VOR*			
Approach: NDB* (check of ADF function)			
Approach: GPS*			
DME: Normal operation*			
TCAS: Normal operation			
Radar Altimeter			
RESULTS: PHASE 2 – FLIGHT TEST PROCEDURE	**N/A**	**SAT**	**UNSAT**
COMMENTS:			

*Perform a check of proper operation of this function during an approach. The equipment name does not need to appear in the Title of the approach. For example, it does not need to be an 'NDB approach'; a check of proper operation is satisfactory.

APPENDIX A: VHF, UHF & DME FREQUENCY PAIRING INFORMATION

Instrument Landing System (ILS)
Localizer: 108.1-111.95 MHz
Glide Slope: 329.15-335.0 MHz
VHF Omnidirectional Range (VOR)
108.0-117.95 MHz
Distance Measuring Equipment (DME)
Air: 1025-1150 MHz
Ground: 962-1213 MHz
Tactical Air Navigation (TACAN)
Air: 1023-1152 MHz
Ground: 960-1215 MHz

Airport Surveillance Radar (ASR)
Primary Surveillance Radar: 2700-2900 MHz

Secondary Surveillance Radar, Transponders, ADS-B and Universal Access Transceivers
Transponder (air): 1090 MHz
SSR (ground): 1030 MHz
UAT (air & ground): 978 MHz (USA only)
Air Route Surveillance Radar (ARSR)
1215-1350 MHz

VHF/UHF Plan for Aeronautical Radionavigation, Frequency Table

Note: SSR and ADS-B operate on TACAN channels 6X, 6Y, 66X, 66Y and 17X.

		DME / TACAN				ILS	
		Air		Ground			
TACAN Channel	VOR MHz	Interrogate MHz	Pulse Code usec	Reply MHz	Pulse Code usec	Localizer MHz	Glide Slope MHz
1X		1025	12	962	12		
1Y		1025	36	1088	30		
2X		1026	12	963	12		
2Y		1026	36	1089	30		
3X		1027	12	964	12		
3Y		1027	36	1090	30		
4X		1028	12	965	12		
4Y		1028	36	1091	30		
5X		1029	12	966	12		
5Y		1029	36	1092	30		
6X		1030	12	967	12		
6Y		1030	36	1093	30		
7X		1031	12	968	12		
7Y		1031	36	1094	30		
8X		1032	12	969	12		
8Y		1032	36	1095	30		
9X		1033	12	970	12		
9Y		1033	36	1096	30		
10X		1034	12	971	12		
10Y		1034	36	1097	30		
11X		1035	12	972	12		
11Y		1035	36	1098	30		
12X		1036	12	973	12		
12Y		1036	36	1099	30		
13X		1037	12	974	12		
13Y		1037	36	1100	30		
14X		1038	12	975	12		
14Y		1038	36	1101	30		
15X		1039	12	976	12		
15Y		1039	36	1102	30		
16X		1040	12	977	12		
16Y		1040	36	1103	30		
17X	108.00	1041	12	978	12		
17Y	108.05	1041	36	1104	30		
18X		1042	12	979	12	108.10	334.70
18Y		1042	36	1105	30	108.15	334.55
19X	108.20	1043	12	980	12		
19Y	108.25	1043	36	1106	30		
20X		1044	12	981	12	108.30	334.10
20Y		1044	36	1107	30	108.35	333.95

		DME / TACAN				ILS	
		Air		Ground			
TACAN Channel	VOR MHz	Interrogate MHz	Pulse Code usec	Reply MHz	Pulse Code usec	Localizer MHz	Glide Slope MHz
21X	108.40	1045	12	982	12		
21Y	108.45	1045	36	1108	30		
22X		1046	12	983	12	108.50	329.90
22Y		1046	36	1109	30	108.55	329.75
23X	108.60	1047	12	984	12		
23Y	108.65	1047	36	1110	30		
24X		1048	12	985	12	108.70	330.50
24Y		1048	36	1111	30	108.75	330.35
25X	108.80	1049	12	986	12		
25Y	108.85	1049	36	1112	30		
26X		1050	12	987	12	108.90	329.30
26Y		1050	36	1113	30	108.95	329.15
27X	109.00	1051	12	988	12		
27Y	109.05	1051	36	1114	30		
28X		1052	12	989	12	109.10	331.40
28Y		1052	36	1115	30	109.15	331.25
29X	109.20	1053	12	990	12		
29Y	109.25	1053	36	1116	30		
30X		1054	12	991	12	109.30	332.00
30Y		1054	36	1117	30	109.35	331.85
31X	109.40	1055	12	992	12		
31Y	109.45	1055	36	1118	30		
32X		1056	12	993	12	109.50	332.60
32Y		1056	36	1119	30	109.55	332.45
33X	109.60	1057	12	994	12		
33Y	109.65	1057	36	1120	30		
34X		1058	12	995	12	109.70	333.20
34Y		1058	36	1121	30	109.75	333.05
35X	109.80	1059	12	996	12		
35Y	109.85	1059	36	1122	30		
36X		1060	12	997	12	109.90	333.80
36Y		1060	36	1123	30	109.95	333.65
37X	110.00	1061	12	998	12		
37Y	110.05	1061	36	1124	30		
38X		1062	12	999	12	110.10	334.40
38Y		1062	36	1125	30	110.15	334.25
39X	110.20	1063	12	1000	12		
39Y	110.25	1063	36	1126	30		
40X		1064	12	1001	12	110.30	335.00
40Y		1064	36	1127	30	110.35	334.85

		DME / TACAN				ILS	
		Air		Ground			
TACAN Channel	VOR MHz	Interrogate MHz	Pulse Code usec	Reply MHz	Pulse Code usec	Localizer MHz	Glide Slope MHz
41X	110.40	1065	12	1002	12		
41Y	110.45	1065	36	1128	30		
42X		1066	12	1003	12	110.50	329.60
42Y		1066	36	1129	30	110.55	329.45
43X	110.60	1067	12	1004	12		
43Y	110.65	1067	36	1130	30		
44X		1068	12	1005	12	110.70	330.20
44Y		1068	36	1131	30	110.75	330.05
45X	110.80	1069	12	1006	12		
45Y	110.85	1069	36	1132	30		
46X		1070	12	1007	12	110.90	330.80
46Y		1070	36	1133	30	110.95	330.65
47X	111.00	1071	12	1008	12		
47Y	111.05	1071	36	1134	30		
48X		1072	12	1009	12	111.10	331.70
48Y		1072	36	1135	30	111.15	331.55
49X	111.20	1073	12	1010	12		
49Y	111.25	1073	36	1136	30		
50X		1074	12	1011	12	111.30	332.30
50Y		1074	36	1137	30	111.35	332.15
51X	111.40	1075	12	1012	12		
51Y	111.45	1075	36	1138	30		
52X		1076	12	1013	12	111.50	332.90
52Y		1076	36	1139	30	111.55	332.75
53X	111.60	1077	12	1014	12		
53Y	111.65	1077	36	1140	30		
54X		1078	12	1015	12	111.70	333.50
54Y		1078	36	1141	30	111.75	333.35
55X	111.80	1079	12	1016	12		
55Y	111.85	1079	36	1142	30		
56X		1080	12	1017	12	111.90	331.10
56Y		1080	36	1143	30	111.95	330.95
57Y	112.05	1081	36	1144	30		
58X	112.10	1082	12	1019	12		
58Y	112.15	1082	36	1145	30		
59X	112.20	1083	12	1020	12		
59Y	112.25	1083	36	1146	30		
60X		1084	12	1021	12		
60Y		1084	36	1147	30		

		DME / TACAN				ILS	
		Air		Ground			
TACAN Channel	VOR MHz	Interrogate MHz	Pulse Code usec	Reply MHz	Pulse Code usec	Localizer MHz	Glide Slope MHz
61X		1085	12	1022	12		
61Y		1085	36	1148	30		
62X		1086	12	1023	12		
62Y		1086	36	1149	30		
63X		1087	12	1024	12		
63Y		1087	36	1150	30		
64X		1088	12	1151	12		
64Y		1088	36	1025	30		
65X		1089	12	1152	12		
65Y		1089	36	1026	30		
66X		1090	12	1153	12		
66Y		1090	36	1027	30		
67X		1091	12	1154	12		
67Y		1091	36	1028	30		
68X		1092	12	1155	12		
68Y		1092	36	1029	30		
69X		1093	12	1156	12		
69Y		1093	36	1030	30		
70X	112.30	1094	12	1157	12		
70Y	112.35	1094	36	1031	30		
71X	112.40	1095	12	1158	12		
71Y	112.45	1095	36	1032	30		
72X	112.50	1096	12	1159	12		
72Y	112.55	1096	36	1033	30		
73X	112.60	1097	12	1160	12		
73Y	112.65	1097	36	1034	30		
74X	112.70	1098	12	1161	12		
74Y	112.75	1098	36	1035	30		
75X	112.80	1099	12	1162	12		
75Y	112.85	1099	36	1036	30		
76X	112.90	1100	12	1163	12		
76Y	112.95	1100	36	1037	30		
77X	113.00	1101	12	1164	12		
77Y	113.05	1101	36	1038	30		
78X	113.10	1102	12	1165	12		
78Y	113.15	1102	36	1039	30		
79X	113.20	1103	12	1166	12		
79Y	113.25	1103	36	1040	30		
80X	113.30	1104	12	1167	12		
80Y	113.35	1104	36	1041	30		

		DME / TACAN				ILS	
		Air		Ground			
TACAN Channel	VOR MHz	Interrogate MHz	Pulse Code usec	Reply MHz	Pulse Code usec	Localizer MHz	Glide Slope MHz
81X	113.40	1105	12	1168	12		
81Y	113.45	1105	36	1041	30		
82X	113.50	1106	12	1169	12		
82Y	113.55	1106	36	1043	30		
83X	113.60	1107	12	1170	12		
83Y	113.65	1107	36	1044	30		
84X	113.70	1108	12	1171	12		
84Y	113.75	1108	36	1045	30		
85X	113.80	1109	12	1172	12		
85Y	113.85	1109	36	1046	30		
86X	113.90	1110	12	1173	12		
86Y	113.95	1110	36	1047	30		
87X	114.00	1111	12	1174	12		
87Y	114.05	1111	36	1048	30		
88X	114.10	1112	12	1175	12		
88Y	114.15	1112	36	1049	30		
89X	114.20	1113	12	1176	12		
89Y	114.25	1113	36	1050	30		
90X	114.30	1114	12	1177	12		
90Y	114.35	1114	36	1051	30		
91X	114.40	1115	12	1178	12		
91Y	114.45	1115	36	1052	30		
92X	114.50	1116	12	1179	12		
92Y	114.55	1116	36	1053	30		
93X	114.60	1117	12	1180	12		
93Y	114.65	1117	36	1054	30		
94X	114.70	1118	12	1181	12		
94Y	114.75	1118	36	1055	30		
95X	114.80	1119	12	1182	12		
95Y	114.85	1119	36	1056	30		
96X	114.90	1120	12	1183	12		
96Y	114.95	1120	36	1057	30		
97X	115.00	1121	12	1184	12		
97Y	115.05	1121	36	1058	30		
98X	115.10	1122	12	1185	12		
98Y	115.15	1122	36	1059	30		
99X	115.20	1123	12	1186	12		
99Y	115.25	1123	36	1060	30		
100X	115.30	1124	12	1187	12		
100Y	115.35	1124	36	1061	30		

		DME / TACAN				ILS	
		Air		Ground			
TACAN Channel	VOR MHz	Interrogate MHz	Pulse Code usec	Reply MHz	Pulse Code usec	Localizer MHz	Glide Slope MHz
101X	115.40	1125	12	1188	12		
101Y	115.45	1125	36	1062	30		
102X	115.50	1126	12	1189	12		
102Y	115.55	1126	36	1063	30		
103X	115.60	1127	12	1190	12		
103Y	115.65	1127	36	1064	30		
104X	115.70	1128	12	1191	12		
104Y	115.75	1128	36	1065	30		
105X	115.80	1129	12	1192	12		
105Y	115.85	1129	36	1066	30		
106X	115.90	1130	12	1193	12		
106Y	115.95	1130	36	1067	30		
107X	116.00	1131	12	1194	12		
107Y	116.05	1131	36	1068	30		
108X	116.10	1132	12	1195	12		
108Y	116.15	1132	36	1069	30		
109X	116.20	1133	12	1196	12		
109Y	116.25	1133	36	1070	30		
110X	116.30	1134	12	1197	12		
110Y	116.35	1134	36	1071	30		
111X	116.40	1135	12	1198	12		
111Y	116.45	1135	36	1072	30		
112X	116.50	1136	12	1199	12		
112Y	116.55	1136	36	1073	30		
113X	116.60	1137	12	1200	12		
113Y	116.65	1137	36	1074	30		
114X	116.70	1138	12	1201	12		

		DME / TACAN				ILS	
		Air		Ground			
TACAN Channel	VOR MHz	Interrogate MHz	Pulse Code usec	Reply MHz	Pulse Code usec	Localizer MHz	Glide Slope MHz
114Y	116.75	1138	36	1075	30		
115X	116.80	1139	12	1202	12		
115Y	116.85	1139	36	1076	30		
116X	116.90	1140	12	1203	12		
116Y	116.95	1140	36	1077	30		
117X	117.00	1141	12	1204	12		
117Y	117.05	1141	36	1078	30		
118X	117.10	1142	12	1205	12		
118Y	117.15	1142	36	1079	30		
119X	117.20	1143	12	1206	12		
119Y	117.25	1143	36	1080	30		
120X	117.30	1144	12	1207	12		
120Y	117.35	1144	36	1081	30		
121X	117.40	1145	12	1208	12		
121Y	117.45	1145	36	1082	30		
122X	117.50	1146	12	1209	12		
122Y	117.55	1146	36	1083	30		
123X	117.60	1147	12	1210	12		
123Y	117.65	1147	36	1084	30		
124X	117.70	1148	12	1211	12		
124Y	117.75	1148	36	1085	30		
125X	117.80	1149	12	1212	12		
125Y	117.85	1149	36	1086	30		
126X	117.90	1150	12	1213	12		
126Y	117.95	1150	36	1087	30		

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